

Moving From Eyeballs to Algorithms



**New Applications and Opportunities
with AI and Ultrasound**

Introduction

The integration of artificial intelligence (AI) with ultrasound technology has primarily focused on improving workflow efficiency or image quality.

For example, handheld ultrasound systems such as Claris and Butterfly use AI to enhance images from minimal data. Additionally, companies like Esaote, Canon and GE have AI software applications designed to improve operational workflow of imaging in medical clinics.

However, a new frontier is emerging where AI augments real-time medical procedures, providing actionable data, improving precision, and expanding ultrasound's role beyond imaging into telemetry and decision support.

AI-Enhanced Ultrasound for Medical Procedures

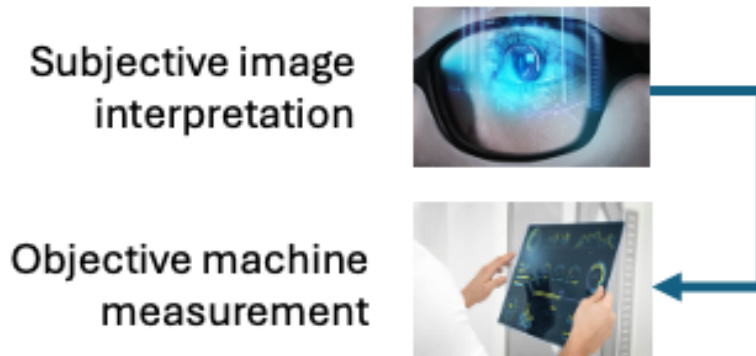
Advanced AI is transforming ultrasound technology from visual interpretation to real-time data analysis that enhances medical procedures. AI-driven ultrasound integrates seamlessly with medical workflows, delivering precise, quantitative data instantly without disrupting clinicians' focus.

This advancement eliminates manual interpretation and enhances diagnostic consistency. The cost-effective and noninvasive nature of ultrasound ensures accessibility, which can revolutionize medical diagnostics and procedural accuracy within medical devices.

Quantitative Data from Ultrasound

- Discovery
- Measurement
- Telemetry
- Location
- Navigation
- Volume
- Flow
- Interpretation

Moving from Eyeballs to Algorithms



Traditionally, ultrasound imaging has relied on human interpretation, making it subject to variability in diagnostic accuracy and efficiency. AI automates image acquisition, analysis, and decision-making, reducing dependency on human perception. AI-driven ultrasound systems process raw data in real time, identifying structures, detecting anomalies, and generating quantitative insights.

Machine learning models trained on vast datasets enable automated segmentation and pattern recognition, assisting clinicians by reducing interpretation time and improving consistency.

Additionally, AI can optimize procedural guidance by adapting imaging parameters dynamically and providing real-time feedback.

AI-powered automation reduces operator dependency, making ultrasound more accessible to non-experts and expanding its use in remote and point-of-care settings.

This integration improves efficiency, enhances accuracy, and lays the foundation for autonomous imaging systems that support clinical decision-making with minimal human intervention.

The Challenges of AI-Driven Ultrasound

Despite advancements, most if not all commercial ultrasound systems are not fully optimized for AI-driven data, measurement and procedural applications.

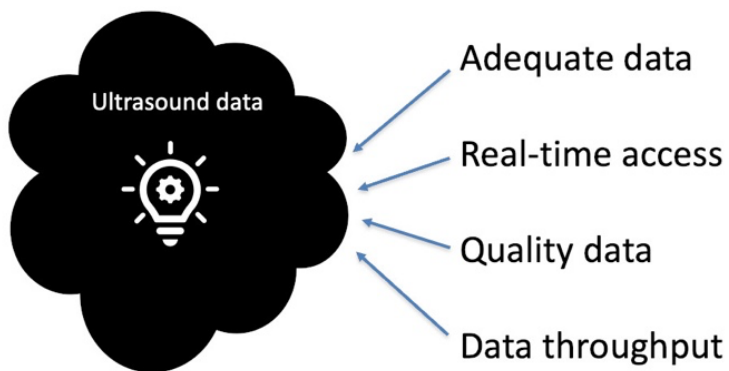
Traditional systems focus on general-purpose imaging rather than procedure-specific AI applications, making real-time AI integration difficult.

Limited computational power, restricted access to raw data, and poor integration flexibility further hinder AI's potential.

AI requires access to large amounts of real-time data, necessitating specialized hardware and software.

AI is only as good as the data it can access.

Effective AI algorithms depend on access to unfiltered data. The better the data, the better the results...



Managing the vast data generated by high-channel count systems remains a challenge.

For example, A 64-channel ultrasound system can produce over 1TB/sec of data, exceeding the capabilities of current commercial systems for real-time processing.

Integrating AI-Enabled Ultrasound into Procedure-Specific Medical Devices

Historically, ultrasound has functioned as a standalone imaging tool. However, the future lies in embedding AI-driven ultrasound within procedure-specific medical devices, such as robotic surgery platforms and interventional systems. This integration transforms ultrasound from an auxiliary diagnostic tool into a core enabler of precision medicine.



AI-powered ultrasound can be embedded directly into computer-aided medical devices, diagnostic systems, robotic surgery platforms, catheter-based interventions, and targeted therapeutic devices.

This enables real-time patient telemetry, image analysis, automated interpretation, and procedural guidance without requiring separate ultrasound consoles.

However, integration requires high-speed data transfer, advanced AI-driven image and data processing, and synchronization with procedural inputs such as robotic movements and catheter positioning.

Why Integrate Ultrasound AI

Potential Uses of AI-powered Ultrasound

- Real-Time Procedural Guidance
- Diagnostic measurements
- Procedure Measurements
- Patient Telemetry
- Robotic Navigation
- Predictive Analytics
- Mapping objects within objects

Integrating AI-powered ultrasound into your medical devices offers you both business and technical benefits for as well as for your customers.

Enhanced Procedural Precision: AI-driven ultrasound provides real-time feedback, improving accuracy in robotic surgery, catheter placements, and ablation therapies.

Workflow Efficiency and Automation: AI streamlines workflows, automates imaging tasks, and minimizes operator variability, increasing efficiency and consistency.

Competitive Differentiation: AI-enhanced ultrasound positions new medical devices as smarter, more automated, and capable of superior outcomes, leading to increased adoption and market expansion.

Regulatory and Safety Advantages: AI can help monitor patient condition, detects anomalies, and prevents errors in real time, improving patient safety and supporting regulatory approvals.

Data-Driven Insights: AI enables continuous learning through real-time procedural data collection, refining algorithms and personalizing imaging for patient-specific needs.

Reduced Operator Dependency: AI automates image interpretation and procedural guidance, reducing reliance on operator expertise and broadening accessibility to complex medical procedures.

A Case Study in Ultrasound AI – Tissue Differentiation Intelligence

Tissue Differentiation Intelligence, is a company that has developed an AI ultrasound procedure support system to support spine surgery.

One of the biggest issues of spine surgery is the risk of damaging various nerves in the back for both feeling and muscle control.



Their objective was to create a new more effective approach to recognize, locate and differentiate nerves, muscles, bones and vessels in real-time during the surgery. This was intended to provide the surgeon significantly more and better data about which paths for which to perform the surgery.

By applying layers of image-processing algorithms to ultrasound images collected intraoperatively, SonoVision is able to differentiate nerve, muscle, bone and vessels in real time. This paves the way for ultrasound to be used as a new imaging modality for spine surgery by overcoming the impracticalities of conventional ultrasound.

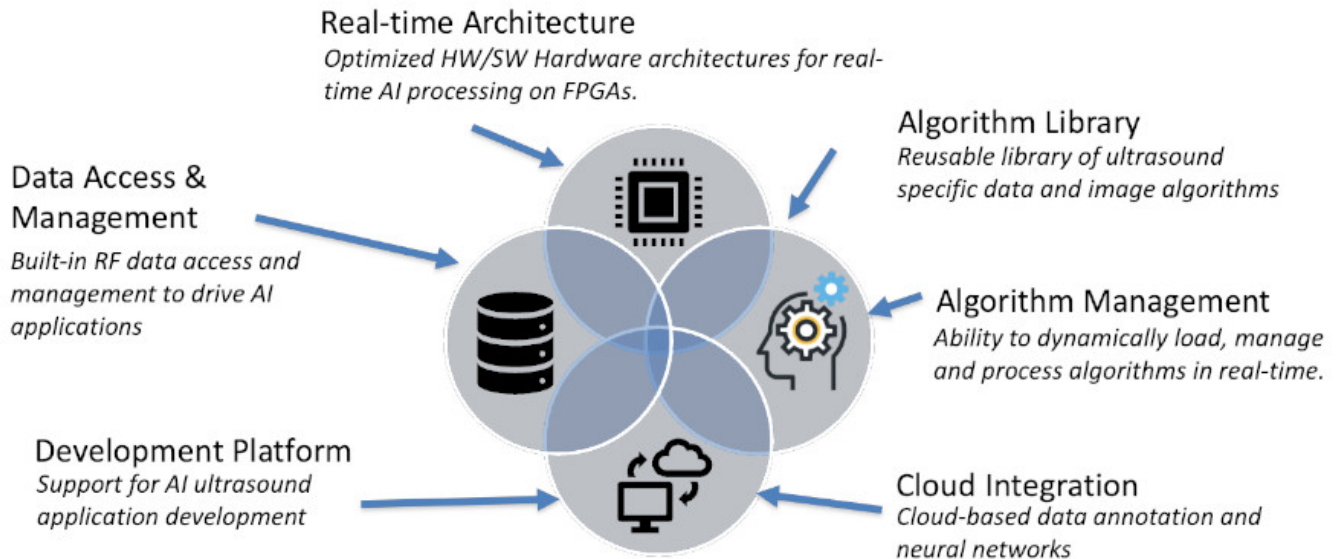
The challenge was to get access to enough of the data to both train the algorithms as well as a technology platform to process the data and algorithms in real time in order for it to be effective in the surgical suite.

The critical AI components that have enabled the Sonovision system are access to unfiltered data, real time processing and the ability to integrate a flexible ultrasound engine that could be programmed for the specific application needed in spine surgery.

They engaged Cephasonics to both provide the ultrasound engine to be able to process the AI algorithms in real time as well as design and development assistance to create and train the algorithms.

Cephasonics' Strategy for AI-Powered Ultrasound

Cephasonics is at the forefront of AI-driven ultrasound, developing platforms that go beyond traditional imaging systems. The company focuses on scalable, modular solutions designed for seamless integration into procedure-specific medical devices, enabling real-time data access, automated interpretation, and intelligent procedural guidance.



To enhance diagnostic accuracy and medical device support, we develop and implement advanced machine learning algorithms specifically designed for ultrasound imaging.

By using our proprietary annotation tools specifically for ultrasound, these models are trained using extensive annotated clinical data from human studies, ensuring they are carefully tailored to interpret and identify imaging characteristics.

By integrating artificial intelligence across the entire imaging pipeline—from real-time analysis to post-processing and reporting—new medical devices gain access valuable data and insights. We also focus on continuous improvement by collaborating closely with medical experts, who help validate data and refine models to ensure they remain effective and aligned with evolving clinical needs.

Unlocking Full Data Access for AI-Powered Insights

Cephasonics systems provide full access to raw ultrasound data, essential for high-performance AI applications.

Unlike conventional systems that limit access to processed images, Cephasonics captures and transmits unfiltered channel data at full speed. This enables superior data analysis, image reconstruction, automated feature extraction, and enhanced diagnostic accuracy. High-speed connectivity and advanced processing optimize data flow, ensuring real-time interpretation without delays.

Seamless Integration with Your Devices

Cephasonics' ultrasound platforms are designed to integrate directly with various medical devices, transforming ultrasound into an AI-enhanced component of diagnostic, interventional and therapeutic systems.

This is achieved through modular architectures, flexible APIs, and high-speed FPGA and GPU processing, enabling compatibility with various medical procedure specific devices.



By embedding AI-driven ultrasound, you can achieve enhanced precision, automated navigation, measurement and telemetry for real-time feedback to your device as well as to the clinician.

For instance, in robotic-assisted surgery, AI-powered ultrasound can adjust navigational parameters dynamically, providing surgeons with

clearer insights. In catheter-based interventions, AI optimizes device placement and improves patient safety by detecting complications early.

Conclusion

The future of ultrasound is AI-driven, shifting from standalone imaging to real-time, data-driven procedural applications integrated in procedure-specific medical devices.

By moving beyond “eyeballs” toward “algorithms,” ultrasound becomes a data-rich, real-time modality that supports precise interventions and improved decision-making. And as AI ultrasound uses continue to evolve and advance it will lead to increasingly complex ultrasound technology & algorithms that will demand more and more AI performance.

Cephasonics is leading this shift with platforms that grant full access to raw data and AI processing that can be integrated in medical devices.

As AI integration advances, ultrasound will continue to evolve from a simple imaging technique into an indispensable, procedure-focused component of modern healthcare—empowering devices with the insights they need to ensure the best possible outcomes.

Cephasonics Products & Services

Cephasonics offers a range of advanced ultrasound solutions designed for both development of and powering ultrasound integrated medical devices. Our scalable platforms provide high-fidelity data acquisition, real-time processing, and full access to raw signals, enabling deep customization and integration into diverse medical devices.

With a focus on combining hardware, software, and AI-driven technologies, Cephasonics empowers developers and OEMs to achieve superior AI and data performance, real-time processing, flexible system integration and reduced time to market.

- Scalable ultrasound engines designed for integration 64-512 channels
- AI ready integrated computer systems with GPUs
- Comprehensive API based SW development environment
- Application ready ultrasound carts
- Probes, CMUT and wearable transducers
- Custom engineering and design consulting
- 13485 turnkey manufacturing services



Complete ultrasound engines



Custom designed
ultrasound



Clinical ready
ultrasound carts

**Ready to enhance your medical device with AI-
powered ultrasound?**

Contact Cephasonics today to discover how our next-generation solutions can elevate your data and telemetry capabilities, streamline workflows, and help you deliver unparalleled care.

Cephasonics Ultrasound
www.cephasonics.com
sales@cephasonics.com
1 (800) 510-4561